MECHANICS.

173. Proposed by J. F. LAWRENCE, A. B., Professor of Mathematics, Oklahoma Agricultural College, Stillwater, Oklahoma.

A squirrel is in a cylindrical cage and oscillating with it about its axis which is horizontal. At the instant when he is at the highest point of the oscillation, he leaps to the opposite extremity of the diameter and arrives there at the same instant as the point at which he left. Determine his leap completely.

[No satisfactory solution has been received.]

174. Proposed by F. P. MATZ, Sc. D., Ph. D., Reading, Pa.

By what per cent. is the striking force of a hailstone increased in falling 1000 feet through a stratum of atmosphere moving uniformly eastward at the rate of 60 miles an hour?

Solution by the PROPOSER.

Let S_1=the *striking-force* of the hail-stone falling 1000 feet, and $S_2=mS_1$ =that caused by the horizontal motion of the atmosphere during the time required to fall 1000 feet; then the resultant striking-force is $\sqrt{(1+m^2)}S_1$. Assuming a mass of ice suitable for a hail-stone, we can easily calculate m.

The required percentage of increase in striking-force becomes

$$I=\left(\frac{\sqrt{(1+m^2)}-1}{1}\right) \text{ of } 100\%.$$

175. Proposed by J. F. LAWRENCE, A. B., Professor of Mathematics. Oklahoma Agricultural College, Stillwater, Oklahoma.

A cylinder descends down a plane, the inclination of which to the horizon is α, unwrapping a fine string fixed at the highest point of the plane. Find the angle through which the plane must be depressed in order that a sphere, descending under like circumstances, may experience the same acceleration.

Solution by G. W. GREENWOOD, M. A., Professor of Mathematics and Astronomy, McKendree College, Lebanon, Ill.

Let ω be the angular velocity, and v the velocity parallel to the plane, after rolling a distance l from the highest point. Equating the *vis viva* of the body to twice the work done by gravity, we get, in the case of the cylinder,

$$\tfrac{1}{2}ma^2\omega^2+mv^2=2mgl\sin\alpha,$$

where a is the radius of the cylinder.

$\therefore 3v^2=4gl\sin\alpha$, since $a\omega=v$.

In the case of the sphere we get

$$\tfrac{2}{5}m'a'\omega^2+m'v^2=2mgl\sin(\alpha-\theta),\ i.\ e.,\ 7v^2=10gl\sin(\alpha-\theta),$$

where θ is the amount of depression of the plane.

$\therefore 14\sin\alpha=15\sin(\alpha-\theta)$, or $\theta=\alpha-\sin^{-1}(\tfrac{14}{15}\sin\alpha)$.